Claim List – Status and Support of Current Amendment Changes

Claim	Status	Type	Support for Current Changes
1	Pending	Method	Col. 8 lines 30 – 55, col. 11 lines 10 – 32.
2	Pending	Method	There are no changes in this amendment.
3	Pending	Method	There are no changes in this amendment.
4	Pending	Method	There are no changes in this amendment.
5	Pending	Method	There are no changes in this amendment.
6	Pending	Method	There are no changes in this amendment.
7	Pending	Method	There are no changes in this amendment.
8	Pending	Method	There are no changes in this amendment.
9	Pending	Method	There are no changes in this amendment.
10	Pending	Method	There are no changes in this amendment.
11	Pending	Method	There are no changes in this amendment.
12	Pending	Method	There are no changes in this amendment.
13	Pending	Method	There are no changes in this amendment.
14	Cancelled	N/A	N/A
15	Pending	Method	There are no changes in this amendment.
16	Pending	Composition	There are no changes in this amendment.
17	Pending	Composition	There are no changes in this amendment.
18	Pending	Composition	There are no changes in this amendment.
19	Pending	Composition	There are no changes in this amendment.
20	Pending	Composition	There are no changes in this amendment.
21-38	Cancelled	N/A	N/A
39	Pending	Composition	There are no changes in this amendment.

Applicant's Response to Examiner's Interview Summary Mailed 05/28/08

Applicant requested and performed a phone interview with the Examiner on May 22, 2008. The Examiner mailed to Applicant an interview summary on May 28, 2008. Applicant responds to said summary according to MPEP 713.04 herein.

The Examiner stated:

After reviewing the references relied upon, the Examiner stated that Lo Sasso's use of the term "nonionic polyacrylamide" is intended to include polyacrylamides comprising up to 5 wt % cationic comonomers. See Lo Sasso col 2 line 64:

methacrylamide. It is also within the scope of this invention to use polyacrylamides containing up to about 5 percent of a cationic comonomer. Some useful cationic comonomers are the dialkyl diallyl ammonium chlorides and 2-hydroxy 3 methacryloxypropyl trimethyl ammonium chloride. The term "nonionic polyacrylamide" includes copolymers of acrylamide and up to about 5 percent by weight of a cationic comonomer. While higher levels of cationic comonomers are compatible with the ferric-containing salts, we prefer to use a nonionic polymer. The preferred comonomer is diacetone

Further, the Examiner stated,

such a showing would overcome this rejection. Parenthetically, the examiner stated that had applicant defined what he meant by "cationic polymer" in the application as originally filed, say, by stating that the term "cationic polymer" meant a polymer having at least x % cationic charge, or the like, the problem may not have arisen.

In response, Applicant would like to respectively state to the Examiner that the Examiner is correct that Applicant does not teach a lower cationic or a lower anionic molecular percentage in the instant application. Applicant would like to respectfully add that the Lo Sasso reference does not teach the dewatering of thermophilic biological sludge.

The Examiner further states:

As for Applicant's second argument that Dentel teaches away from using a cationic polyacrylamide in combination with an inorganic salt, the examiner first noted that neither of the two Dentel references cited by applicant at pages 7 – 8 appears to be of record.[3] For that reason alone, the "teaching away" argument is not persuasive. To the

extent, however, that the reference Applicant refers to as Dentel, "*Evaluation of Dual Chemical Conditioning and Dewatering of Aerobically Digested Biosolids*, August 18, 1996," describes substantially the same content as Chitikela (of record), the examiner notes that Chitikela does not teach away from the combination of Eberhard and Lo Sasso because Chitikela does not teach away from using an inorganic salt in combination with a cationic polyacrylamide: To the contrary, Chitikela at Fig 2 (page 11-31) describes the best dewatering performance (shortest Capillary Suction Time, or CST) as accomplished using a combination of first adding ferric chloride followed by addition of PERCOL 757, a cationic polyacrylamide (see middle of page 11-26), to a biological sludge, albeit not a *thermophilic* digested biosludge. See Fig 2 for " O -- O " 3.0 g/L ferric chloride" data.

In response, Applicant respectfully presents to the Examiner, first: that Applicant apologizes to the Examiner; as, the cited reference by Applicant was not of record. With this RCE and via an IDS, Applicant makes of record Dentel, Steven K. and Chitikela, Srinivasarao; *Evaluation of Dual Chemical Conditioning and Dewatering of Anaerobically Digested Biosolids The Final Report Sludge Dewaterability Assessment for East Bay Municipal Utility District (EBMUD) California*, June 1995 (Dentel 1995).

Within Dentel 1995, there are many arguments presented which teach away from the instant invention. Specifically:

1. On page 2 is stated,

   "The inorganic conditioners require dosages up to 20% on the solids basis and **<u>typically cannot produce the solids concentrations in dewatered biosolids that are attainable with much lower dosages of polymer</u>** [e.g. cationic polyacrylamide].

   Thus, **<u>in spite of their higher unit cost, organic polymers have largely displaced inorganic chemicals in sludge conditioning and dewatering processes</u>**. U.S. polymer sales for this purpose are estimated at $130 million per year (Dentel et al., 1995). The expense of polymer purchases is usually the greatest single cost component in biosolids management, and thus represents a considerable portion of overall treatment costs. At

some treatment facilities where polymer demand is unusually high, this expense may even exceed secondary treatment aeration costs." **(Emphasis added)**

2. On page 6 is stated,

   "Figures 1 and 2 show the results of conditioning and dewatering results for both the EBMUD and Philadelphia sludges, when conditioned with Percol 757, ferric chloride, or HDTMA individually. These results once again confirm that cationic polymers are **very effective in sludge conditioning when compared to** the inorganic chemical conditioning with ferric chloride." **(Emphasis added)**

3. On page 7 is stated,

   "Two dosages of ferric chloride, approximately 1500 and 3000 mg/L, were selected for use in preconditioning of EBMUD sludge. These dosages were at roughly 25% and 50% of the optimum dose for ferric chloride alone, and low enough to avoid significant pH change. In a similar manner, two dosages of ferric chloride, approximately 1300 and 2500 mg/L, were selected for dual conditioning and dewatering of the Philadelphia sludge. In the case of HDTMA, doses of 1000 and 2000 mg/L were selected with reference to the results in Figures 1 and 2. Conditioning and CST tests were then performed varying the dose of Percol 757 [e.g. cationic polyacrylamide] that followed the ferric chloride or HDTMA.

   Figures 6 and 7 show the CST results after dual chemical conditioning of EBMUD and Philadelphia sludges respectively. Figures 8 and 9 show the SC values for the same experiments."

4. And, then, on page 10 is stated,

   "Although preconditioning with ferric chloride reduced the cationic polymer requirement, these results indicate that **the process was not cost effective**." **(Emphasis added)**, while in conclusion

5. On page 11 is stated,

   "The use of ferric chloride or HDTMA (a quaternary salt) as a preconditioner can reduce the polymer requirement, but **this is not a cost effective option** at current prices for these additives." **(Emphasis added)**

Therefore, Dentel 1995 teaches that the economic (cost) viability of the results presented in figure 8 and 9 is not effective, therein stating "the process was not cost effective" and that "this is

not a cost effective option". Given the significant cost considerations, as previously presented in Dentel 1995, e.g. item 1 above, Dentel 1995 teaches away from the use of an iron salt in combination with a cationic polyacrylamide in the dewatering of biosolids.

Second, Applicant would like to respectfully present to the Examiner that the cited reference, Chitikela, Srinivasarao and Dentel, Steven K.; *Evaluation of Dual Chemical Conditioning and Dewatering of Anaerobically Digested Biosolids*, 10'th Annual Residuals & Biosolids Management Conference: 10 years of Progress and a Look Toward the Future, August 18-21, 1996 (Chitikela 1996), comprises the same teachings as Dentel 1995. Specifically,

6. On page 11-25 is stated,

   "In the past, ferric chloride was more commonly used in conjunction with lime, but the current practice is generally to use cationic polymers (polyelectrolytes) [e.g. cationic polyacrylamides] alone. <u>The inorganic conditioners require doses of up to 20 percent on a dry solids basis and typically cannot produce the solids concentrations in dewatered biosolids that are attainable with much lower dosages of polymer</u> (approximately 1 percent on a dry weight basis)." **(Emphasis added)**

7. On page 11-26 is stated,

   "**Methods**: i) Conditioning of sludges was conducted the general procedure given in the Guidance Manual for Selection of Polymers in Wastewater Treatment (WEF, 1993), ii) Conditioning and dewatering of sludges by Percol 757, ferric chloride, or HDTMA alone: A representative 0.5L volume of each sludge was placed in a 1.0 L beaker and rapidly mixed with the household blending mixer for 6-7 seconds after addition of the specified dose of Percol 757, ferric chloride, or HDTMA. Then using the jar test apparatus, rapid mixing was conducted for 20 seconds at approximately 117 RPM, and finally, the suspension was flocculated at approximately 28 rpm for 2 minutes. The suspension's pH, CST and streaming current (SC) values were then measured."

8. Then, on page 11-27 is stated,

   "Comparison of results of single conditioner dosages. Figure 1 provides the results of conditioning and dewatering results for the EBMUD sludge, when conditioned with Percol 757, ferric chloride or HDTMA individually. <u>These results once again confirm that cationic polymers are very effective in sludge conditioning when compared to the inorganic chemical conditioning with ferric chloride</u>. ... To obtain a CST of approximately 10 seconds, the required Percol 757 additions for EBMUD and Philadelphia respectively were

0.215 and 0.180 g/L or, on a mass per mass basis, 10 and 7.5 kg/Mg (i.e., 1% and 0.75% respectively). The ferric chloride additions never reduced the CST to 10 seconds for either sample, but to provide a CST of 15 seconds the doses were 6.0 and 5.2 g/L respectively (280 and 215 kg/Mg and which are 28% and 21.5% respectively). In the case of HDTMA, at a dose of 7.0 g/L the final CSTs of both EBMUD and Philadelphia sludges were reduced to 32 and 27 seconds respectively. **(Emphasis added)**

9. On page 11-28 is stated,

"Evaluation of results of dual conditioning. Two dosages of ferric chloride, approximately 1.5 g/L (the smaller dose) and 3.0 g/L (the larger dose), were selected for use in preconditioning of EBMUD sludge. These dosages were at roughly 25% and 50% of the optimum dose for ferric chloride alone, and low enough to avoid significant pH change. In a similar manner, two dosages of ferric chloride, approximately 1.3 g/L (the smaller dose) and 2.5 g/L (the larger dose), were selected for dual conditioning and dewatering of the Philadelphia sludge. Figure 2 shows he CST results after dual chemical conditioning of EBMUD sludge. The SC results for the same experiments are presented in Figure [3]. Comparison of these results showed that a streaming current reading between -20 and -25 corresponded to the optimal dose of the conditioner. Unlike the comparisons between single conditioning chemicals (Figure 1), the CST values attained with the conditioner combinations all converged to a similar weight polymer is needed to attain this result, although the polymer, ferric chloride, or surfactant is adequate to accomplish the initial degree of charge neutralization.

Of course, **the feasibility** of such a substitution depends on the actual amounts of each chemical required and the corresponding costs. Tables 1 and 2 show the pounds of Percol 757 and ferric chloride, and Percol 757 and HDTMA required to give a CST of 10 seconds, which is assumed to correspond to satisfactory dewaterability. ... As seen in these tables, either ferric chloride or HDTMA can reduce the Percol 757 requirement significantly. As a rule of thumb, it appears that adding a proportion of one chemical's optimum dosage changes the requirement of the other by the same amount. For example, the optimum dosage of ferric chloride if used alone in conditioning the EBMUD sludge is about 0.56 g/L; adding 50% of this dosage reduced the polymer (e.g. cationic polyacrylamide) to about

50% of its dosage if used alone. If this rule were empirically true, it would always be most economical to use only one of the conditioning chemicals by itself.

... Table 3 shows the resulting costs of polymer (e.g. cationic polyacrylamide) itself in dewatered solids, and Figure 4 shows total conditioner cost (Percol 757 plus ferric chloride) as a function of the initial dose of ferric chloride. ... Although preconditioning with ferric chloride reduced the cationic polymer requirement, these results indicate that the process **was not cost effective**. The same conclusion is likely to apply in general since the relative costs of ferric chloride and the polymer (e.g. cationic polyacrylamide) would have to change substantially to alter the trend shown in Figure 4." **(Emphasis added)**

10. And on page 11, the conclusion, states,

"The use of ferric chloride or HDTMA (a quaternary salt) as a preconditioner can reduce the polymer requirement, but **this is not a cost effective option** at current prices for these additives." **(Emphasis added)**

Therefore, in a similar manner to that of Dentel 1995, Chitikela 1996 does teach away from the use of an iron salt as a preconditioner to a cationic polyacrylamide in the dewatering of biological solids. And, therefore, both Dentel 1995 and Chitikela 1996 teach away from the instant claims. Applicant respectfully refers the Examiner to MPEP 2145 D, MPEP 2145 X and KSR International v. Teleflex, Inc. et al., No. 04-1350, 550 U.S. __(2007), all of which are attached herein.

The above is while Dentel 1995 on page 2, first paragraph, states:

"The **means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood**, with the optimal amounts and types of conditioners required depending on a variety of factors. These include both **aqueous and surface chemistries of the sludge**, and the **physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant**. Also important is **the chemistry of any chemical conditioner used, and how it interacts with the biosolids**." **(Emphasis added)**

And, Chitikela 1996 states on page 11-25,

"The optimal chemical conditioning and dewatering of a municipal sludge is a challenging task. **The means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood**, with the

optimal amounts and types of conditioners required depending on variety of factors. These include both **aqueous and surface chemistries of the sludge**, and the **physical properties of the suspended solids**. Also **important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids**."

The above statements and teachings from June 1995 and August 1996 are while the parent application for the instant invention, e.g. 08/721,557, was filed on 09/26/96 and the application for the instant invention was filed on 04/06/98. Therefore, at the time of the instant invention, "means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water [was] poorly understood". This is while at the time of the instant invention, Dentel 1995 and Chitikela 1996 demonstrate that "the optimal amounts and types of conditioners required depending on a variety of factors": 1) "aqueous and surface chemistries of the sludge", 2) "physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant", and 3) "the chemistry of any chemical conditioner used, and how it interacts with the Biosolids".

These teachings at the time of the instant invention are while none of the cited references alone or in combination teach a "method for dewatering thermophilic biological sludge" comprising any of the factors. This is while the instant invention teaches for the dewatering of a thermophilic biological sludge, 1) "aqueous and surface chemistries of the sludge" in column 2:

> Despite the disadvantages of mesophyllic bacteria, mesophyllic bacteria are preferable in relation to the dewatering of digested sludge. Mesophyllic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophilic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophilic bacteria naturally repel each other. This repelling nature of thermophilic bacteria makes the dewatering of sludge from the thermophilic digestion process expensive and difficult.

The instant invention also teaches, 2) "physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant" in column 2:

> medium of microbial growth. At temperatures of at least about 115° F., active bacteria are of the thermophilic variety. Aerobic and/or anaerobic thermophilic microorganisms are used to carry out any required degradation in a thermophilic,

> exothermic process. The thermophilic digestion system relies on high operating temperatures (greater than about 55° C. or 131° F.) to achieve a substantial pathogen destruction. While a fraction of the energy released from the thermophilic process is stored intracellularly to form new cells, a larger fraction of the energy is released as heat into the environment. The released heat is the major heat source used to achieve the desired operating temperature. Experiments have shown that between about 8,500 and 13,000 BTU are released with the thermophilic digestion of one pound of volatile solids (bacteria). By maintaining a sufficient temperature for a required period of time, pathogenic organisms are reduced to below detectable levels.

Lastly, the instant invention teaches, 3) "the chemistry of any chemical conditioner used, and how it interacts with the biosolids" in column 4:

> The present invention relates to the dewatering of sludge from biological treatment systems of wastewater treatment facilities. Specifically, this invention is directed toward the removal of water from sludge that has been digested by a thermophilic digestion process. A chemical method is presented for the dewatering of biological sludge using polyquaternary amine, aluminum sulfate, ferric chloride and blends thereof as the primary component.

And, in columns 8 and 9:

> In method five as well, the polymeric quaternary ammonium compounds are from DADMAC family or from epi-DMA family. In a preferred embodiment, the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof are added directly to the sludge and, upon formation of microflocs of the sludge from the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof, a cationic polyacrylamide is added to form a floc that dewaters the sludge. Preferably, ratios of the polymeric quaternary ammonium compounds with respect to aluminum sulfate range from about 1:16 to about 1:2 by weight. Ratios of the polymeric quaternary ammonium compounds with respect to ferric chloride range from about 1:8 to about 1:10 by weight. Ratios of the polyacrylamide with respect to aluminum sulfate range from about 1:80 to about 1:8 by weight. Ratios of the polyacrylamide with respect to ferric chloride range from about 1:70 to about 1:7 by weight.
>
> Method five also involves a polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge of between about 50 ppm:1 percent and about 300 ppm:1 percent. The polymeric quaternary ammonium compound,

aluminum sulfate, ferric chloride and blends thereof are added directly to the sludge, in an amount sufficient to cause formation of a cationic overcharge within a developed microfloc system, and an anionic polyacrylamide is then added for fmal floc formation. In a preferred embodiment, the polymeric quaternary ammonium compound and the anionic polyacrylamide are in an approximately 1:8 to 20:1

ratio by weight. In a preferred embodiment, polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between approximately 50 ppm:1 percent and approximately 5000 ppm:1 percent.

Method five can also be used to treat a mixture of biological sludge with primary sludge. In addition, the polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof, as well as polyacrylamide, can be used in solution, in emulsion or in dry form.

Therefore, at the time of the instant invention "means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water was poorly understood", while it was known at the time of the instant invention that three teachings were needed to understand said means, all of which are taught by Applicant, specifically:

1. "Aqueous and surface chemistries of the sludge",
2. "Physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant", and
3. "The chemistry of any chemical conditioner used, and how it interacts with the biosolids".

Therefore, Applicant discovered "the source of the problem" and taught "the source of the problem" as taught in the instant invention. This is while "the source of the problem" to dewater thermophilic biosolids was not taught or suggested by others, as was required in the art.

The above is while Dentel 1995 further states on page 2 that:

"**The success of any conditioning process will also depend on the specific dewatering process employed**.

Thus, the conditioning process is **a multivariate problem with no simple strategy available for optimization**. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, **the use of**

<u>**multiple chemical additives becomes less feasible because of the difficulty in identifying a proper dosage combination**</u>." **(Emphasis added)**

And, Chitikela 1996 further states that,

"The success of any conditioning process will also depend on the specific dewatering process employed. Thus, the sludge conditioning process is a multivariate problem with no simple strategy available for its optimization. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, the use of multiple chemical additives become less feasible because of the difficulty in identifying a proper dose combination."

Therefore, the instant invention could not have been obvious at the time of filing for the instant invention; as:

1. Both Dentel 1995 and Chitikela 1996 taught not to practice the instant invention and instant claims (teaching away),
2. There is no teaching or suggestion within any cited reference for the three required teachings in the dewatering of a thermophilic biological sludge; wherein, all three of the required teachings are accomplished by the instant invention (source of the problem), and
3. At the time of the instant invention it was "less feasible" to develop the instant invention due to the "difficulty" of a "multivariate problem". This teaching is presented for a traditional mesophilic biological sludge; therefore, the difficulty is enhanced and the feasibility is reduced with the further complication of a thermophilic biological sludge (undue experimentation to develop the instant claims).

<u>Examiner's OA Objections and Rejections Along with Applicant's Argument</u>

In the OA, the Examiner argues:

USP 5019267 to Eberhard describes a method of dewatering biological sludge from a constant 50°C (col 5 line 58) digestion process by adding a cationic polymeric flocculent, i.e., Zetag 92, to the thermophilic biological sludge. As evidenced by USP 5561520 to Williams, Zetag 92 is an ultra-high molecular weight polyacrylamide carrying

a medium charge density (col 6 line 10) Accordingly, Eberhard describes a method of dewatering a thermophilic biological sludge in which a cationic polyacrylamdie is added to the thermophilic biological sludge. Eberhard does not describe adding aluminum sulfate or ferric chloride to the thermophilic biological sludge.

USP 3642619 to Lo Sasso describes a synergistic benefit is using a combination of cationic polyacrylamide and ferric chloride to effect dewatering of a biological sludge. The skilled artisan would have had a reasonable expectation of success in improved dewatering performance of Eberhard's thermophilic biological sludge by using a combination of ferric chloride and Zetag 92, as suggested by Lo Sasso.

Applicant refers the Examiner to the above arguments in relation to Dentel 1995 and Chitikela 1996. In furtherance to above "teaching away" argument and the above argument that the prior art does not "identify the source of the problem", Applicant refers the Examiner to a timely publication from the US EPA, a pre-eminent authority in wastewater treatment and in dewatering (this citation provided by Applicant in OAR dated 12/27/07). Specifically, the US EPA document TBS Prakasam, et al. *Effect of Recycling Thermophilic Sludge on the Activated Sludge Process,* EPA Project Summary 5, Sept. 1990 states under the heading of Dewaterability:

> "Capillary suction time (CST) measurements at various polymer dosages indicated that mesophilic sludge required a lower polymer dosage than did the thermophilic sludge (10 vs. 22.5 kg/dry tonne) to achieve the minimum CST that was possible. The thermophilic sludge, however, exhibited highest floc strength than did the messophilic sludge.
>
> Pilot scale centrifuge studies confirmed that the thermophilic sludge required a higher polymer dosage than did the messophilic sludge. At optimal polymer dosages, those studies also indicated that the mesophilic sludge approached 100% solids capture whereas the thermophilic solids approached a maximum of 96% solids capture. The lower solids capture with thermophilic sludge probably resulted from the higher concentration of fine particles in it than in the messophilic sludge."

In contrast and in solution to the US EPA cited challenge, Applicant refers the Examiner to Example 9 of the instant specification, which is located in col. 11 lines 10 to 33.

The report goes on to recommend that:

> "Based on the lack of effect on sludge mass end the increase in digestion capability required, the Torpsy process is not recommended for Chicago's conventional rate activated sludge plants. Nor is thermophilic digestion as the terminal sludge digestion process recommended if the sludge is to be used at a site with nearby neighbors."

Therefore, the US EPA, **a pre-eminent authority** (e.g. one of expert sill in the art and of much greater skill than one of ordinary skill in the art) was not able to practice the instant invention from the available teachings, e.g. the Examiner's citations, at the time of the instant invention. Therefore, it was not obvious to condition a thermophilic biological sludge with an iron or an aluminum salt prior to the use of a cationic or an anionic polyacrylamide.

This above is most important in relation to the Lo Sasso citation. As previously presented to the Examiner, Lo Sasso does not teach the dewatering of thermophilic bio-solids, as does Applicant in the instant invention. This is while at the time of the instant invention, those of ordinary skill in the art would have had available the Dentel 1995 reference, as previously presented to the Examiner and quoted above, which teaches NOT to use a salt of iron with a cationic polyacrylamide in the dewatering of bio-solids. This is while those of ordinary skill in the art would have had available the Chitikela 1996 reference, which teaches NOT to use a salt of iron with a cationic polyacrylamide in the dewatering of bio-solids. This is while those of ordinary skill in the art would have had available the US EPA reference, which teaches not to even perform the dewatering of thermophilic biosolids. Therefore, for one of ordinary skill in the art to have developed the instant invention and the instant claims from the citations referenced by the Examiner at the time of the instant invention, one of ordinary skill in the art would have had to: 1) apply Lo Sasso to the dewatering of thermophilic bio-solids when there is no teaching in Lo Sasso in relation to thermophilic bio-solids, 2) ignore the fact that cationic polyacrylamides alone are unsuccessful in the watering of thermophilic bio-solids, as described in the instant invention and supported by the US EPA, and use a cationic polyacrylamide anyway, 3) ignore the teachings of Dentel 1995 and apply the use of an iron (or an aluminum salt) as a preconditioner to the thermophilic biological sludge prior to use of a cationic or an anionic polyacrylamide anyway, 4) ignore the teachings of Chitikela 1996 and apply the use of an iron (or an aluminum salt) as a preconditioner to the thermophilic biological sludge prior to use of a cationic or an anionic polyacrylamide anyway, and 5) apply all of the above in light of Eberhard, while Eberhard teaches the use of an enzyme and a chelant, all the

while ignoring the use of an enzyme and a chelant as taught in Eberhard, while 6) replacing both the enzyme and the chelant in Eberhard with an iron or an aluminum salt.

Applicant would like to present to the Examiner that such an irrational path is not a path for one of ordinary skill in the art; or quite frankly, for one of expert skill in the art. There are just too many irrational decisions which must be made with the cited references at the time of the instant invention without having the teaching and/or understanding of the source of the problem as taught in the instant invention. Most importantly, obviousness to try applies to teachings for the same purpose. At the time of the instant invention, there was no obviousness to try the pre-conditioning of ANY biological sludge with an iron or aluminum salt prior to the use of a cationic polyacrylamide due to the teachings of Dentel 1995 and Chitikela 1996. This is while the instant invention **is for a different purpose, e.g. the dewatering of "thermophilic" bio-solids as compared to "mesophilic bio-solids"; and, it would have been obvious to one of ordinary skill in the art that the dewatering of thermophilic bio-solids is a "different purpose" than the dewatering of "mesophilic bio-solids"; as, mesophilic bio-solids are traditionally easily and economically dewatered with a cationic polyacrylamide, while as taught and demonstrated in the instant invention, as well as the US EPA, thermophilic bio-solids are difficult at best to dewater with a cationic polyacrylamide. Therefore, and without question, to one of ordinary skill in the art, the dewatering of messophilic bio-solids and the dewatering of thermophilic bio-solids are different purposes. Lo Sasso, Dentel, Chitikela and Williams are different purposes than the instant invention, e.g. messophilic bio-solids while the instant invention is thermophilic bio-solids.**

Given the requirements of rather irrational decision making for one of ordinary skill in the art at the time of the instant invention to develop the instant invention, Applicant would like to suggest that the Examiner's cited combination, e.g. Eberhard, Williams and Lo Sasso, is "hindsight reconstruction". Applicant refers the Examiner to MPEP 2141.01 III and KSR International v. Teleflex, Inc. et al., No. 04-1350, 550 U.S. __(2007), both of which are attached herein.

The Examiner argues:

Claims 2 and 3 specify more specifically than in claim 1 the chemical identity of the polyquaternary ammonium compound, but none of claims 1 – 5, 7 requires that the polyquaternary ammonium compound or aluminum sulfate be present. Claim 1 merely

states that the primary component "***may*** also comprise" the polyquaternary ammonium compound (emphasis added").

Applicant has respectfully amended independent claim 1 to read:

1. A method for dewatering thermophilic biological sludge, comprising:
a. adding a primary component to the thermophilic biological sludge, the primary component comprising one of:
aluminum sulfate,
ferric chloride,
aluminum sulfate and a polymeric quaternary ammonium compound,
ferric chloride and a polymeric quaternary ammonium compound, and
aluminum sulfate, ferric chloride and a polymeric quaternary ammonium compound; and
b. adding a cationic or anionic polyacrylamide to the thermophilic biological sludge.

Applicant has respectfully traversed the Examiner's Argument.

The Examiner argues:

> Per claims 8-9, the concentration of a dewatering polymer relative to solids content in a dewatering operation was at the time the invention was made known to have an effect on the dewatering performance. Therefore, it would have been obvious to have varied and optimize this parameter for particular sludges.

Applicant would like to respectfully quote MPEP Section 2143.03 which states, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious *In re Fine*, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988." Applicant herein respectfully requests an allowance of claims 8 – 9 as presented herein; as, the Examiner's argument has been respectfully traversed relating to independent claim 1 from which dependant claims 8 – 9 depend.

The Examiner argues:

> Per claim 39/17, it was well known to mixed primary sludge with digested sludge in such processes, so it would have been obvious to have done so using Eberhard's process as well. See for example, United States Patents: 4380496, 3613564, 3397139.

Applicant would like to respectfully quote MPEP Section 2143.03 which states, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious *In re Fine*, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988." Therefore, Applicant herein respectfully requests an allowance of claim 39 as presented herein; as, the Examiner's argument has been traversed relating to independent claim 17 from which dependant claim 39 depends.

The Examiner argues:

Claim 16, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eberhard in view of Williams and Lo Sasso.

USP 4193869 is directed to wastewater treatment. It teaches that organic polymers can be used with an inorganic coagulant such as ferric chloride and aluminum sulfate (alum) while USP 5500131 to Metz teaches that combinations of ferric chloride and aluminum sulfate flocculents can be used. It would have been obvious therefore to have used aluminum sulfate in place of ferric chloride, or to have used a combination of ferric chloride and aluminum sulfate in the Eberhard method as modified by Lo Sasso, as suggested by Metz or USP 4193869.

Applicant wishes to repeat the above arguments:

1. Teaching away - (Dentel 1995, Chitikela 1996 and US EPA),
2. Identification of the problem - (Dentel 1995, Chitikela 1996, US EPA & instant invention),
3. Undue experimentation (Dentel 1995 & Chitikela 1996), and
4. Hindsight reconstruction (Examiner citations, Dentel 1995, Chitikela 1996, US EPA & instant invention),

in relation to an iron salt or an aluminum salt in combination with a cationic or anionic polyacrylamide in the dewatering of thermophilic bio-solids.

Non-Obviousness

Applicant has presented relevant facts which demonstrate that the hypothetical person having ordinary skill in the art would not have found the invention as a whole obvious. Specifically, Applicant has respectfully demonstrated to the Examiner:

1. The scope and content of the prior art - Notable references taught away from the instant invention and the instant invention claims at the time of the instant invention, while teaching that the instant invention would require undue experimentation. This is while notable references teach the knowledge of three factors to understand the dewatering of biosolids; none of the cited references teach the three factors in the dewatering of thermophilic biosolids.
2. The differences between the prior art and the claims at issue - The prior art of record does not teach the "source of the problem" or "a method to dewater thermophilic biosolids". This is while, again, the prior art of record establishes three required teachings in relation to the dewatering of biosolids; after which, Applicant is the first to have met the required teachings for the instant invention as claimed within the instant claims.
3. The level of ordinary skill in the pertinent art – At the time of the instant invention and relating to those of ordinary skill in the art, a pre-eminent authority, one of expert skill in the art - the US EPA, taught away from the instant invention. Therefore, it is obvious that the instant invention would not have been obvious to the hypothetical person having ordinary skill in the art at the time of the instant invention.

<u>Secondary Consideration – Commercial Success and Copying by Others</u>

As a further indication of non-obviousness and as demonstrated in instant application example 9 (as well as examples 6 and 7 for a polyquaternary amine in combination with a polyacrylamide), Applicant demonstrated the instant invention and instant invention claims at the wastewater plant for College Station Texas. As evidenced in the previously submitted declarations of both Richard Haase and Audrey Haase, the instant invention and instant invention claims were placed in use after teaching by Applicant in the operation of the dewatering of thermophilic biological sludge at the wastewater treatment plant for College Station Texas. This copying and commercial success by others further demonstrates non-obviousness of the instant invention and the instant invention claims; as, if the instant invention or the instant invention claims had been obvious, the instant invention or the instant invention claims would have been in use prior to demonstration by Applicant. This is especially true since as demonstrated by the above US EPA document; there had been a need prior to the instant invention since at least 1990 to dewater thermophilic bio-solids. In further support of this argument, Applicant refers the Examiner to MPEP 716.01.

Supplemental Reissue Declaration Required

Applicant has enclosed a Supplemental Reissue Declaration.

Applicant Requests Claim Allowance

Applicant has respectfully traversed all of the Examiner's rejections. Applicant herein respectfully requests an allowance of claims 1 – 13, 15 – 20 and 39 as presented herein.

MPEP and Case Law References

Applicant respectfully refers the Examiner to MPEP 2141.02:

> "[A] **patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified.** This is part of the 'subject matter as a whole' which should always be considered in determining the obviousness of an invention under 35 U.S.C. § 103." *In re Sponnoble*, 405 F.2d 578, 585, 160 USPQ 237, 243 (CCPA 1969). However, "discovery of the cause of a problem ... does not always result in a patentable invention. . . . **[A] different situation exists where the solution is obvious from prior art** **which contains the same solution for a similar problem**." *In re Wiseman*, 596 F.2d 1019, 1022, 201 USPQ 658, 661 (CCPA 1979) (emphasis in original)." **(Emphasis added)**

Applicant respectfully refers the Examiner to MPEP 2145 D:

> **References Teach Away from the Invention or Render Prior Art Unsatisfactory for Intended Purpose**
>
> In addition to the material below, see **MPEP § 2141.02 (prior art must be considered in its entirety, including disclosures that teach away from the claims)** and **MPEP § 2143.01** (proposed modification cannot render the prior art unsatisfactory for its intended purpose or change the principle of operation of a reference). **(Emphasis added)**
>
> **1. The Nature of the Teaching Is Highly Relevant**
>
> **A prior art reference that "teaches away" from the claimed invention is a significant factor to be considered in determining obviousness**; however, "the nature of the teaching is highly relevant and must be weighed in substance. A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994) (Claims were directed to an epoxy resin based printed circuit material. A prior art reference disclosed a polyester-imide resin based printed circuit material, and taught that although epoxy resin based materials have acceptable stability and some degree of flexibility, they are inferior to polyester-imide resin based materials. The court held the claims would have been obvious over the prior art because the reference taught epoxy resin based material was useful for applicant's purpose, applicant did not distinguish the claimed epoxy from the prior art epoxy, and applicant asserted no discovery beyond what was known to the art.).
>
> Furthermore, "the prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed...." *In re Fulton*, 391 F.3d 1195, 1201, 73 USPQ2d 1141, 1146 (Fed. Cir. 2004). **(Emphasis added)**
>
> **2. References Cannot Be Combined Where Reference Teaches Away from Their Combination**

It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983) (The claimed catalyst which contained both iron and an alkali metal was not suggested by the combination of a reference which taught the interchangeability of antimony and alkali metal with the same beneficial result, combined with a reference expressly excluding antimony from, and adding iron to, a catalyst.).

Applicant respectfully refers the Examiner to MPEP 2141.01 III:

CONTENT OF THE PRIOR ART IS DETERMINED AT THE TIME THE INVENTION WAS MADE TO AVOID HINDSIGHT

The requirement "at the time the invention was made" is to avoid impermissible hindsight. See **MPEP § 2145**, paragraph X.A. for a discussion of rebutting applicants' arguments that a rejection is based on hindsight.

"It is difficult but necessary that the decision maker forget what he or she has been taught . . . about the claimed invention and cast the mind back to the time the invention was made (often as here many years), to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art." *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

Applicant respectfully refers the Examiner to MPEP 2145 X:

ARGUING IMPROPER RATIONALES FOR COMBINING REFERENCES

A. Impermissible Hindsight

Applicants may argue that the examiner's conclusion of obviousness is based on improper hindsight reasoning. However, "[a]ny judgement on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account **only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, such a reconstruction is proper.**" *In re McLaughlin* 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971). Applicants may also argue that the combination of two or more references is "hindsight" because "express" motivation to combine the references is lacking. However, there is no requirement that an "express, written motivation to combine must appear in prior art references before a finding of obviousness." See *Ruiz v. A.B. Chance Co.*, 357 F.3d 1270, 1276, 69 USPQ2d 1686, 1690 (Fed. Cir. 2004). For example, motivation to combine prior art references may exist in the nature of the problem to be solved (*Ruiz* at 1276, 69 USPQ2d at 1690) or the knowledge of one of ordinary skill in the art (*National Steel Car v. Canadian Pacific Railway Ltd.*, 357 F.3d 1319, 1338, 69 USPQ2d 1641, 1656 (Fed. Cir. 2004)). See **MPEP § 2143.01** for a discussion of proper motivation to combine references. **(Emphasis added)**

Applicant respectfully refers the Examiner to MPEP MPEP 716.06:

Another form of secondary evidence which may be presented by applicants during prosecution of an application, but which is more often presented during litigation, is evidence that competitors in the marketplace are copying the invention instead of using the prior art.

> However, more than the mere fact of copying is necessary to make that action significant because copying may be attributable to other factors such as a lack of concern for patent property or contempt for the patentees ability to enforce the patent. *Cable Electric Products, Inc. v. Genmark, Inc.*, 770 F.2d 1015, 226 USPQ 881 (Fed. Cir. 1985). Evidence of copying was persuasive of nonobviousness when an alleged infringer tried for a substantial length of time to design a product or process similar to the claimed invention, but failed and then copied the claimed invention instead. *Dow Chem. Co. v. American Cyanamid Co.*, 837 F.2d 469, 2 USPQ2d 1350 (Fed. Cir. 1987). Alleged copying is not persuasive of nonobviousness when the copy is not identical to the claimed product, and the other manufacturer had not expended great effort to develop its own solution. *Pentec, Inc. v. Graphic Controls Corp.*, 776 F.2d 309, 227 USPQ 766 (Fed. Cir. 1985). See also *Vandenberg v. Dairy Equipment Co.*, 740 F.2d 1560, 1568, 224 USPQ 195, 199 (Fed. Cir. 1984) (evidence of copying not found persuasive of nonobviousness) and *Panduit Corp. v. Dennison Manufacturing Co.*, 774 F.2d 1082, 1098-99, 227 USPQ 337, 348, 349 (Fed. Cir. 1985), *vacated on other grounds*, 475 U.S. 809, 229 USPQ 478 (1986), *on remand*, 810 F.2d 1561, 1 USPQ2d 1593 (Fed. Cir. 1987) (evidence of copying found persuasive of nonobviousness where admitted infringer failed to satisfactorily produce a solution after 10 years of effort and expense).

Applicant respectfully refers the Examiner to MPEP 716.06:

> Applicants may compare the claimed invention with prior art that is more closely related to the invention than the prior art relied upon by the examiner. *In re Holladay*, 584 F.2d 384, 199 USPQ 516 (CCPA 1978); *Ex parte Humber*, 217 USPQ 265 (Bd. App. 1961) (Claims to a 13-chloro substituted compound were rejected as obvious over nonchlorinated analogs of the claimed compound. Evidence showing unexpected results for the claimed compound as compared with the 9-, 12-, and 14- chloro derivatives of the compound rebutted the *prima facie* case of obviousness because the compounds compared against were closer to the claimed invention than the prior art relied upon.).

Finally, Applicant refers the Examiner to recent U.S. Supreme Court Case Law, KSR International v. Teleflex, Inc. et al., No. 04-1350, 550 U.S. __(2007).

> **4. The Federal Circuit's perspective on the problem of hindsight is itself problematic. This Court cautioned in *Graham* against "read[ing] into the prior art the teachings of the invention in issue." 383 U.S. at 36. The Court did not perceive, however, any need for extraordinary showings of obviousness to avoid that danger. The Federal Circuit's rigid test underestimates the capacity of courts and the PTO to avoid the influence of hindsight. Retrospective analysis is not unique to patent law, but regularly arises in a wide variety of contexts, including the determination of the competency of counsel in criminal proceedings, see, *e.g.*, *Rompilla* v. *Beard*, 125 S. Ct. 2456, 2462 (2005), reasonable use of force by police officers, see, *e.g.*, *Graham* v. *Connor*, 490 U.S. 386, 396 (1989),**

and probable cause, see, *e.g.*, *Maryland* v. *Garrison*, 480 U.S. 79, 85 (1987). In those situations, as in *Graham*, the Court has consistently recognized that decisionmakers can avoid the improper influence of hindsight by maintaining conscious awareness of its potentially distorting influence in the decisionmaking process.[10] Courts routinely find, for example, an absence of probable cause in cases in which the police in fact find substantial quantities of contraband in a search. There is no reason to think that courts in patent cases cannot be similarly discerning.

The "ultimate question" of patent validity under Section 103(a) is a question of law. *Graham*, 383 U.S. at 17. It rests on a legal judgment, informed by relevant facts, of whether the hypothetical person having ordinary skill in the art would have found the invention as a whole "obvious." Section 103(a) itself identifies three "central factors relevant to any inquiry into obviousness" (*Johnston*, 425 U.S. at 226): the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of ordinary skill in the pertinent art. See *Graham*, 383 U.S. at 17. Other "secondary considerations" —including a long-felt and unfulfilled need for the invention, the prior failures of others, and the commercial success of the invention—may also provide "indicia" supporting the legal conclusion of "obviousness or nonobviousness," *id.* at 17-18, 35-36, but those considerations will not render an obvious invention patentable. *Anderson's-Black Rock, Inc.* v. *Pavement Salvage Co.*, 396 U.S. 57, 61 (1969) (citing *Great Atl. & Pac. Tea Co.* v. *Supermarket Equip. Corp.*, 340 U.S. 147, 153 (1950)).

CONCLUSION

Applicant respectfully requests entry of this RCE, OAR and amendment, along with favorable reconsideration of the pending claims. Applicant has respectfully provided to the Examiner numerous facts and argument which support allowance of the claims. Specifically, Applicant has respectfully provided to the Examiner relevant facts and argument relating to:

1. Teaching away by notable published references at the time of the instant invention,
2. Discovery of the source of the problem, as evidenced in the instant application and required by notable published references at the time of the instant invention,
3. Hindsight reconstruction, as evidenced in the Examiner's Citations when taken in context to notable publications at the time of the instant invention,
4. Copying by others, as evidenced in secondary considerations, and
5. Commercial success by others, as evidenced in secondary considerations, while

relating relevant facts and argument back to recent relevant U.S. Supreme Court Case Law.

This amendment places the claims in a condition for allowance. Applicant requests that in view of this fact, this request for continued examination, office action response and amendment be entered, and after due consideration of the facts presented herein, the claims be allowed and a certificate be issued.

To facilitate the resolution of any issues or questions presented by this paper, Applicant respectfully requests that the Examiner directly contact the undersigned by phone to further the discussion, reconsideration and allowance of the claims.

Respectfully submitted,

Richard A. Haase, Pro Se' Applicant

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Richard A. Haase
4402 Ringrose Drive
Missouri City, Texas 77459

Telephone: 281.261.9543
Facsimile: 281.261.6505
richard@clearvalue.com